

# REPORT DOCUMENTATION PAGE

Form Approved  
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

1. REPORT DATE (DD-MM-YYYY)	2. REPORT TYPE Technical Papers	3. DATES COVERED (From - To)
-----------------------------	------------------------------------	------------------------------

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)	5d. PROJECT NUMBER 2302
	5e. TASK NUMBER MIG2
	5f. WORK UNIT NUMBER 346120

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)  Air Force Research Laboratory (AFMC) AFRL/PRS 5 Pollux Drive Edwards AFB CA 93524-7048	8. PERFORMING ORGANIZATION REPORT
---	-----------------------------------

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)  Air Force Research Laboratory (AFMC) AFRL/PRS 5 Pollux Drive Edwards AFB CA 93524-7048	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S NUMBER(S) Please see attached

12. DISTRIBUTION / AVAILABILITY STATEMENT  
  
Approved for public release; distribution unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

20030129 112

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT  A	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON Leilani Richardson
a. REPORT Unclassified	b. ABSTRACT Unclassified	c. THIS PAGE Unclassified			19b. TELEPHONE NUMBER (include area code) (661) 275-5015

MEMORANDUM FOR PRS (In-House Publication)

FROM: PROI (STINFO)

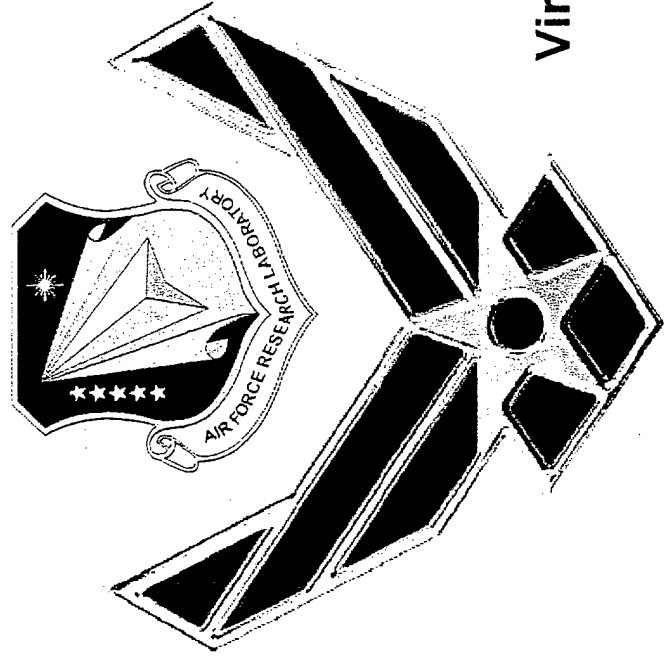
29 Oct 2001

SUBJECT: Authorization for Release of Technical Information, Control Number: **AFRL-PR-ED-VG-2001-211**  
- C.T. Liu (PRSM), C.W. Smith (Virginia Poly Inst.), "Near Tip Behavior in a Particulate Composite Material Under Constant Strain Rates Including Temperature and Thickness Effects"

10<sup>th</sup> International Conf. on Fracture  
(Hawaii, 3-7 Dec 2001) (Deadline: 23 Nov 01)

(Statement A)

# NEAR TIP BEHAVIOR IN A PARTICULATE COMPOSITE MATERIAL UNDER CONSTANT STRAIN RATES INCLUDING TEMPERATURE AND THICKNESS EFFECTS



C.T. Liu

Air Force Research Laboratory

AFRL/PRSM

10E. Saturn Blvd.

Edwards AFB CA 93524-7680

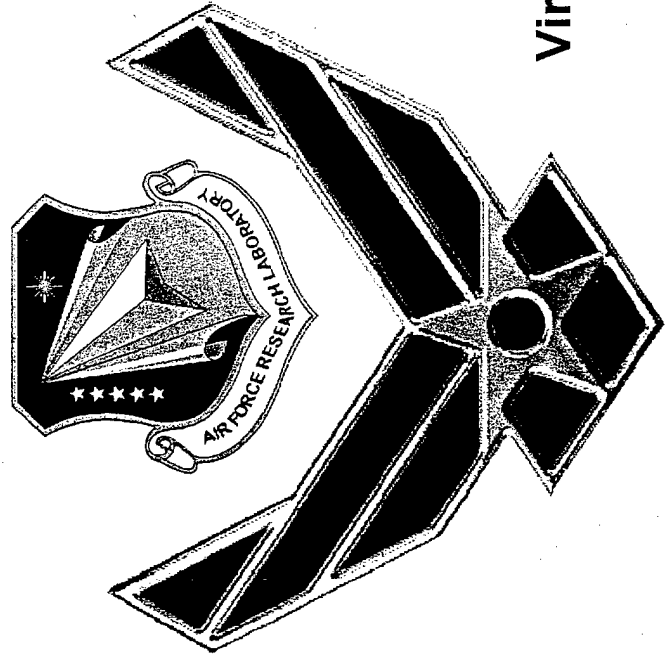
C.W. Smith

ESM Department

Virginia Polytechnic Institute and State University

Blacksburg VA 24061

# NEAR TIP BEHAVIOR IN A PARTICULATE COMPOSITE MATERIAL UNDER CONSTANT STRAIN RATES INCLUDING TEMPERATURE AND THICKNESS EFFECTS



C.T. Liu

Air Force Research Laboratory

AFRL/PRSM

10E. Saturn Blvd.

1-7680

Edwar

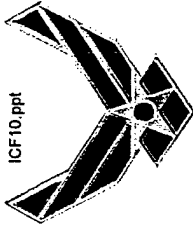
Please add a  
space between  
"10" and "E."

Smith

rtment

Virginia Polytechnic Institute and State University

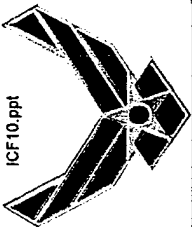
Blacksburg VA 24061



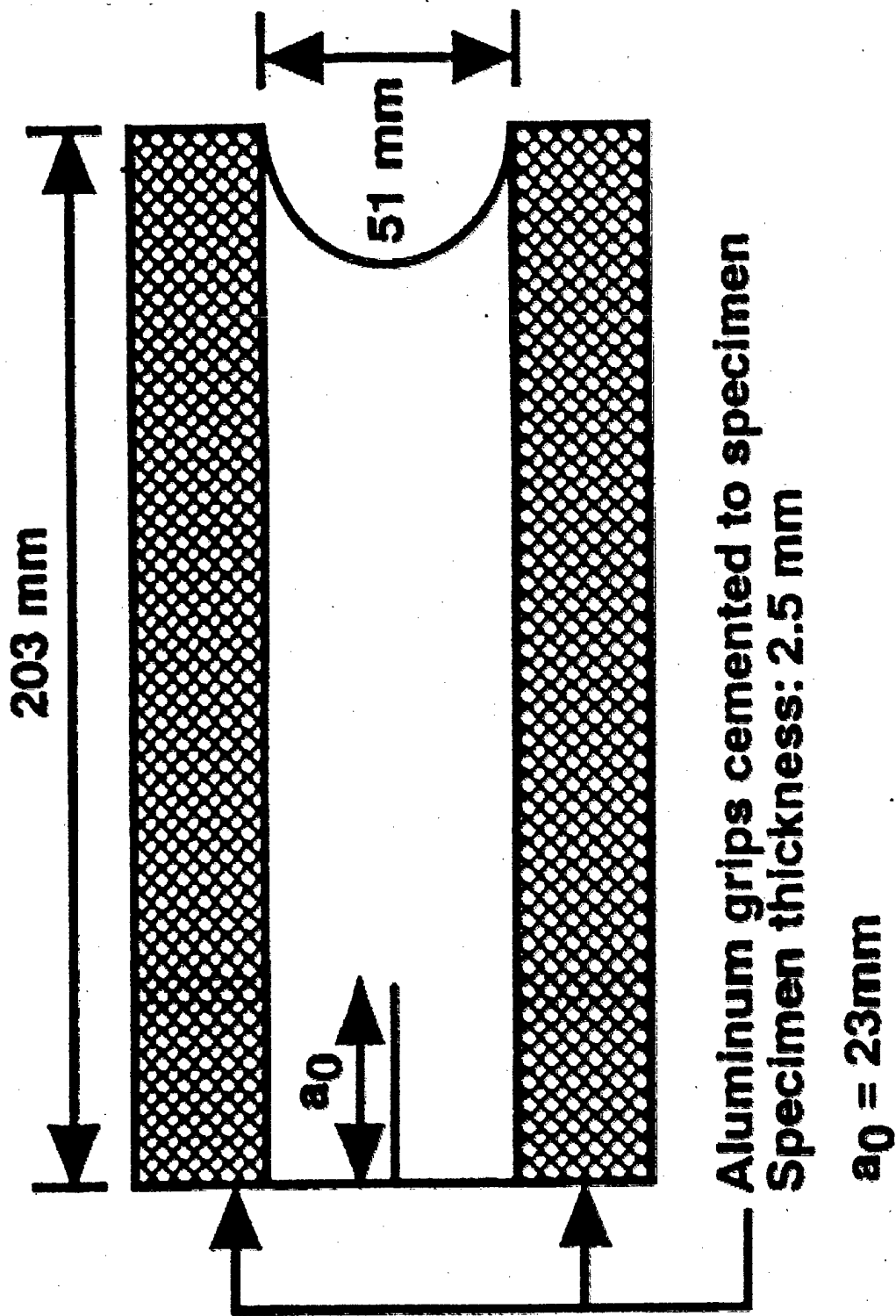
# Objectives

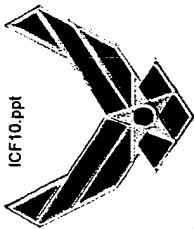


- Investigate the Effects of Temperature and Specimen Thickness on Local Strain Fields and Crack Growth Behavior in a Particulate Composite Material.
- Temperatures:  $-53.9^{\circ}\text{C}$ ,  $22.2^{\circ}\text{C}$ , and  $73.9^{\circ}\text{C}$
- Specimen Thickness': 2.54 mm and 12.7 mm

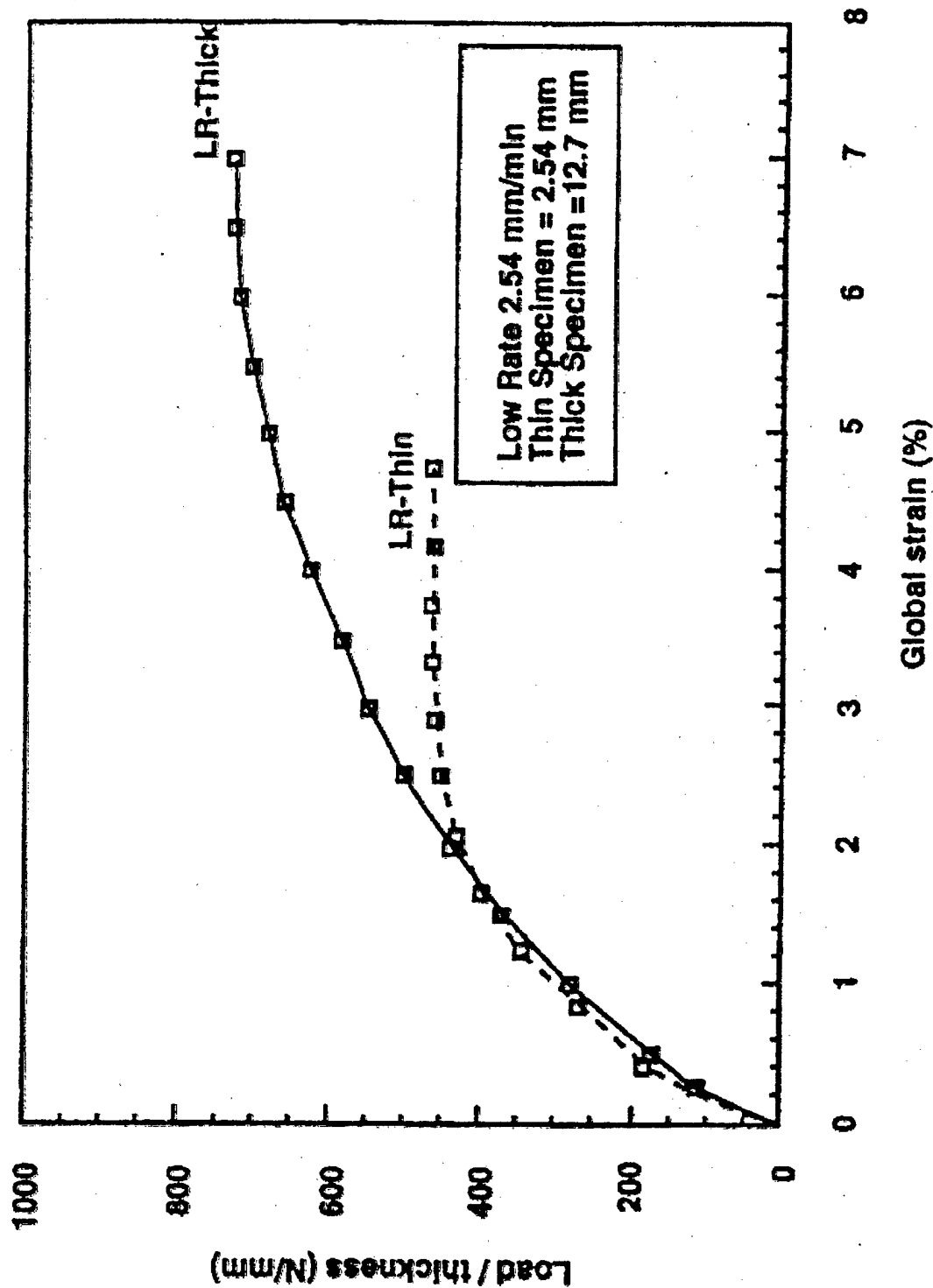


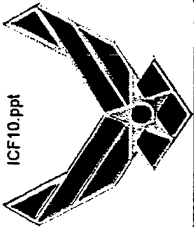
# Specimen Geometry



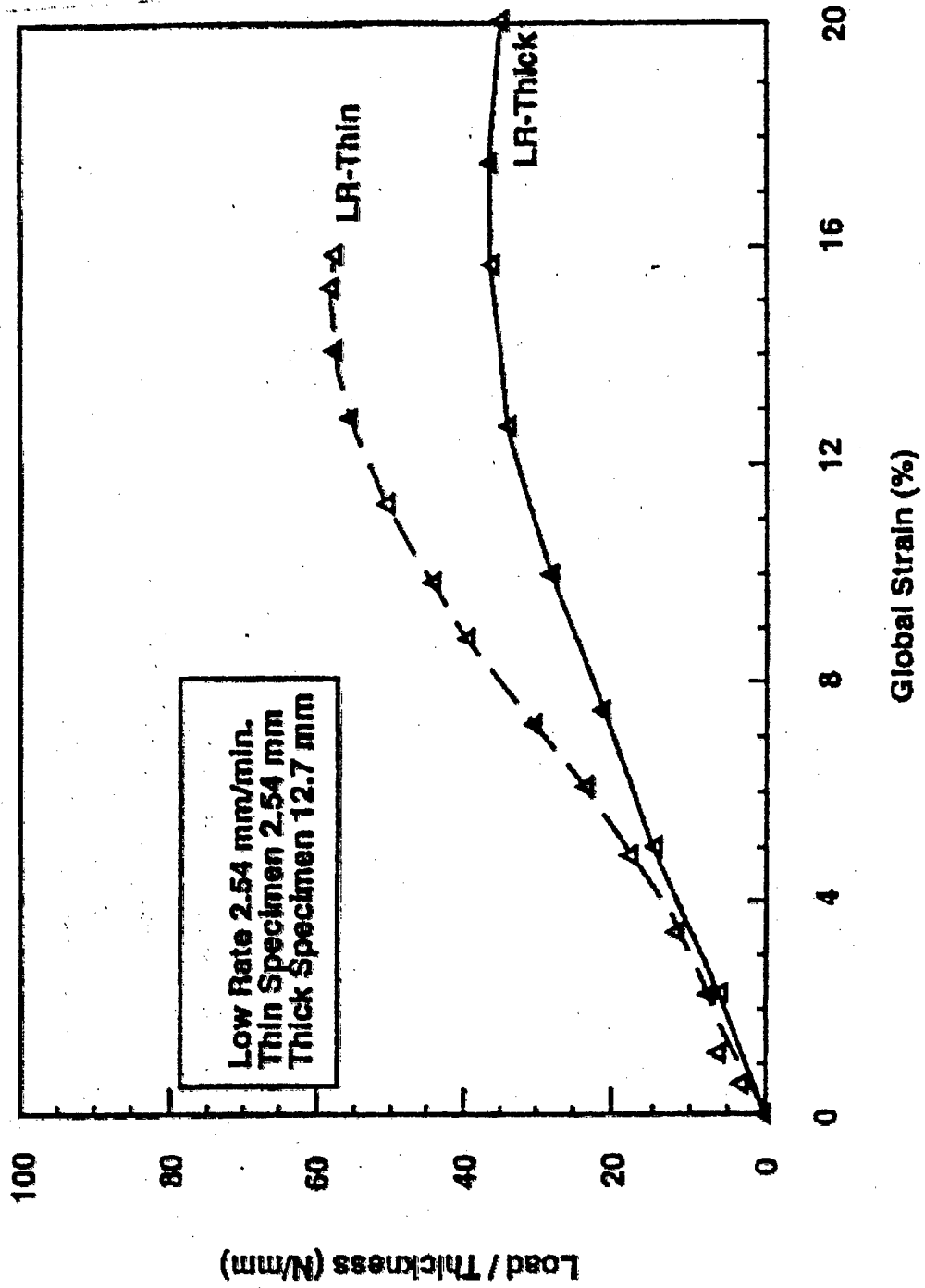


# Load-Strain Relations ( $T = -53.9^{\circ}\text{C}$ )

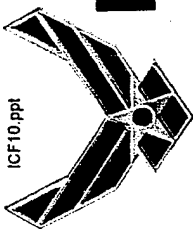




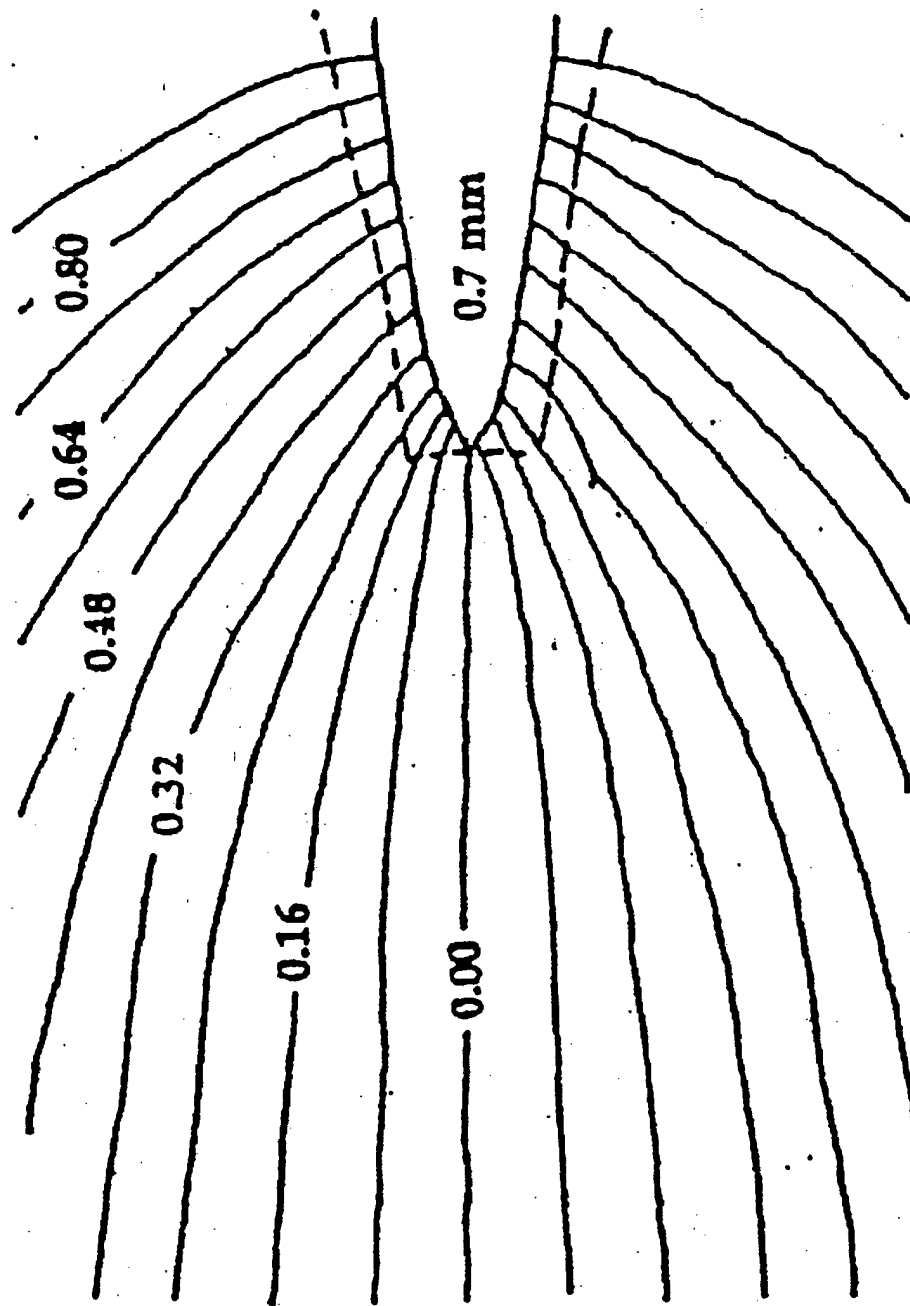
# Load-Strain Relations ( $T=73.9^{\circ}\text{C}$ )

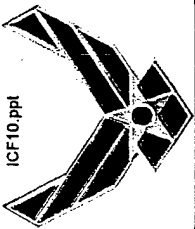




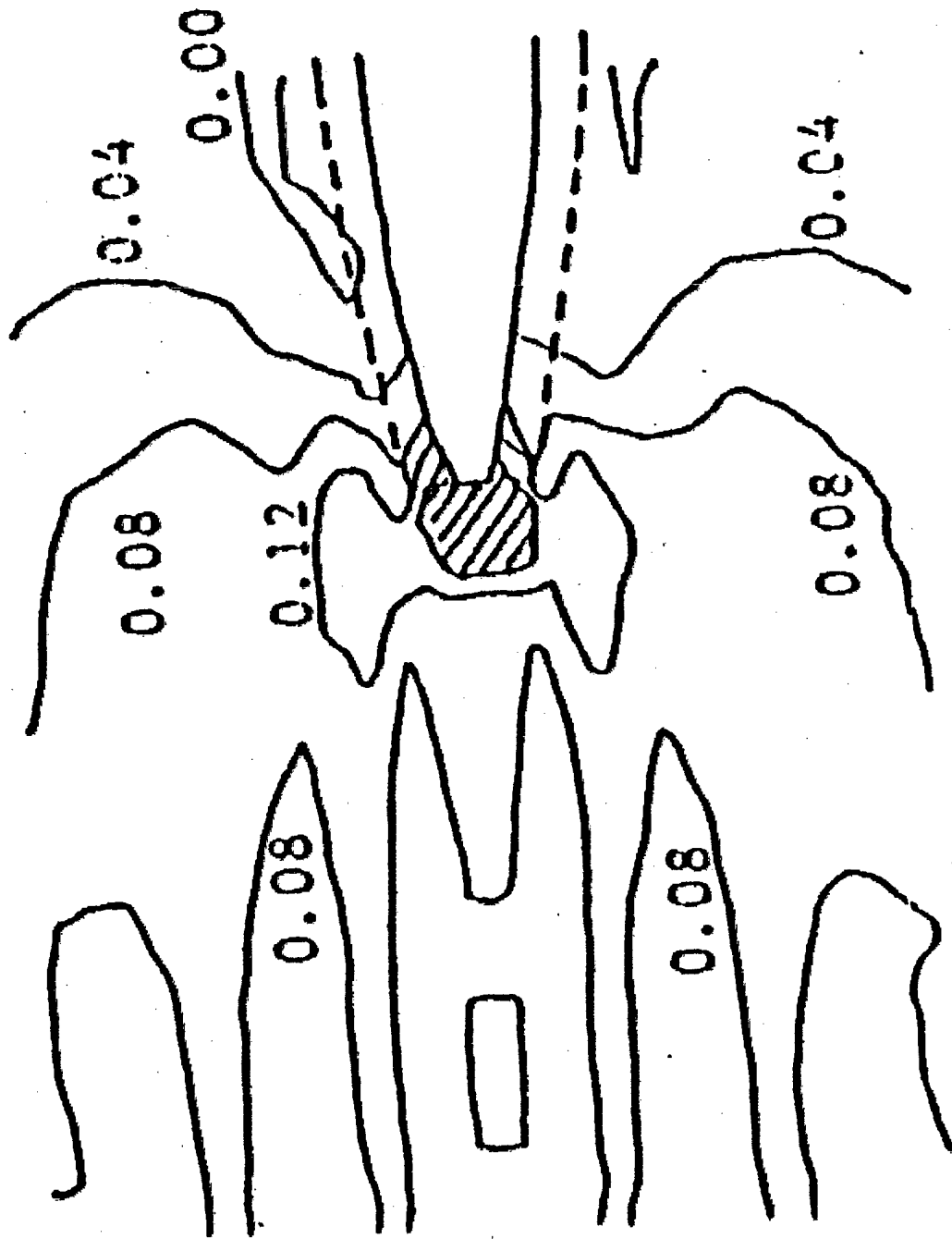


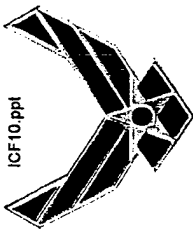
# Typical Contour Plots of Normal Displacement ( $T = -53.9^{\circ}\text{C}$ , $t = 2.54\text{mm}$ )



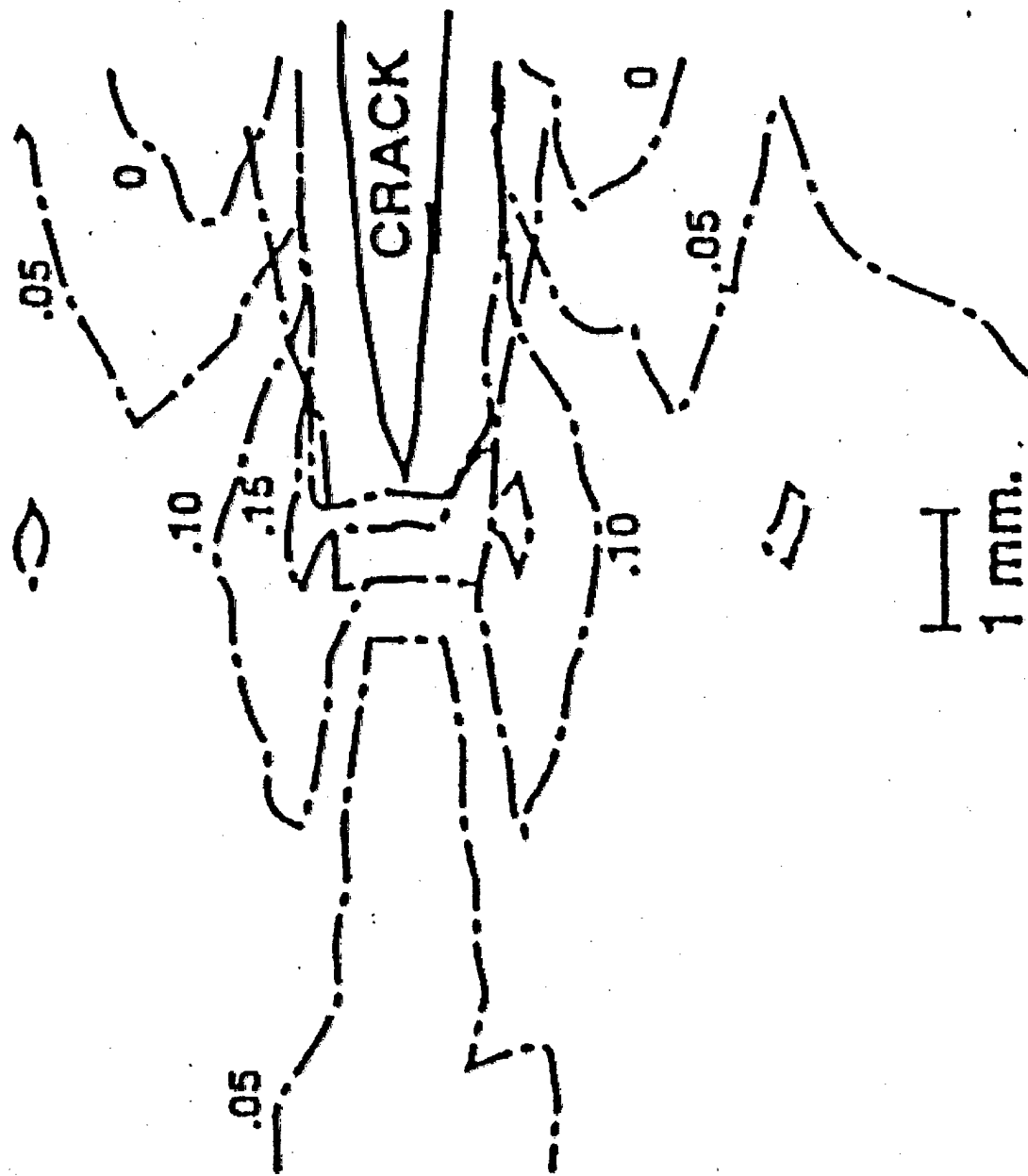


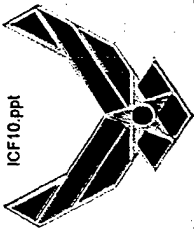
Thickness = 2.54mm



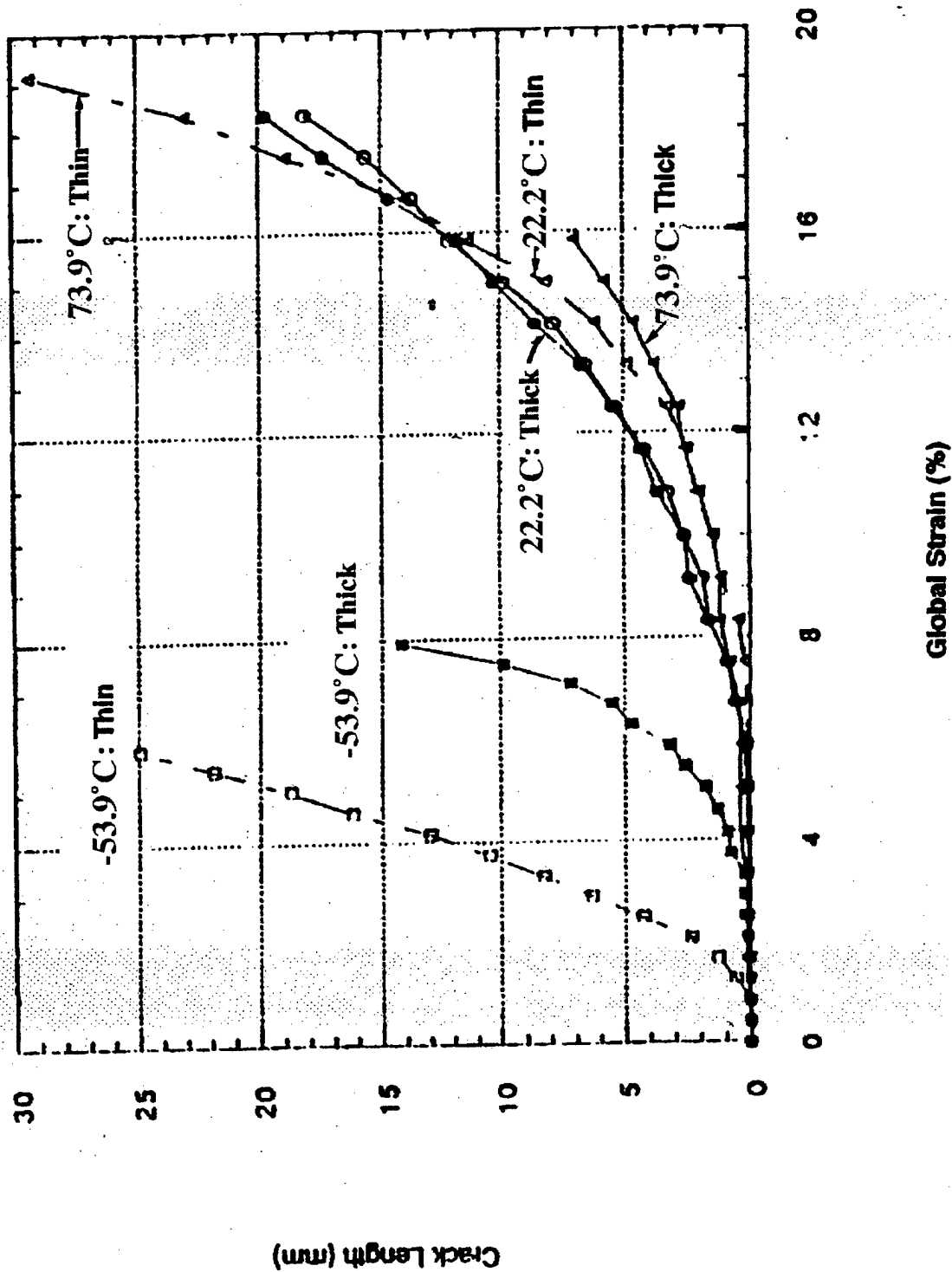


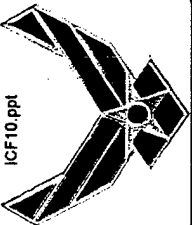
# Thickness = 12.7mm



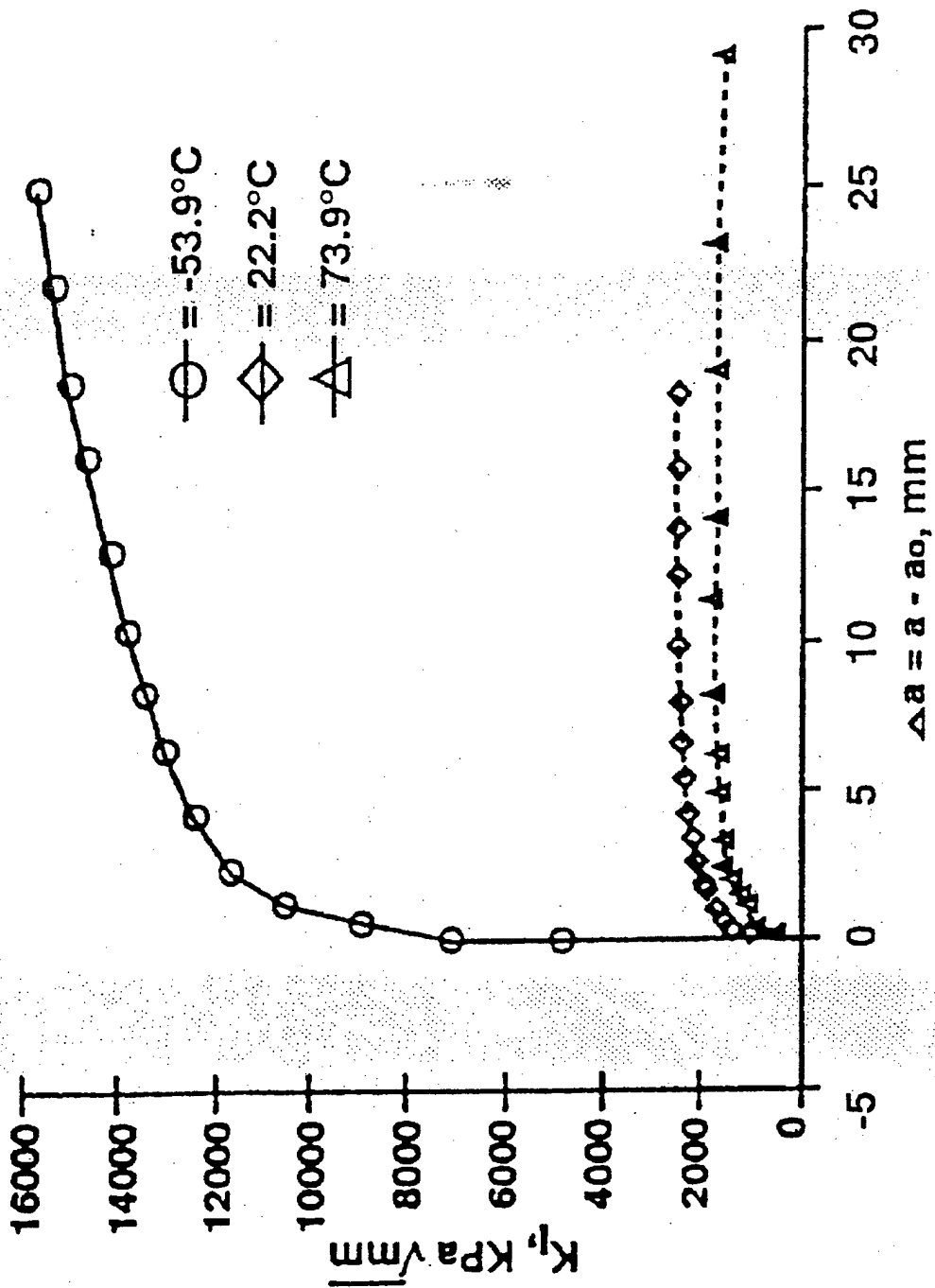


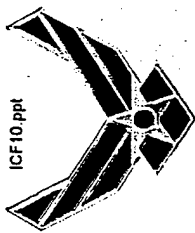
# Crack Length (mm) Versus Global Strain (%)



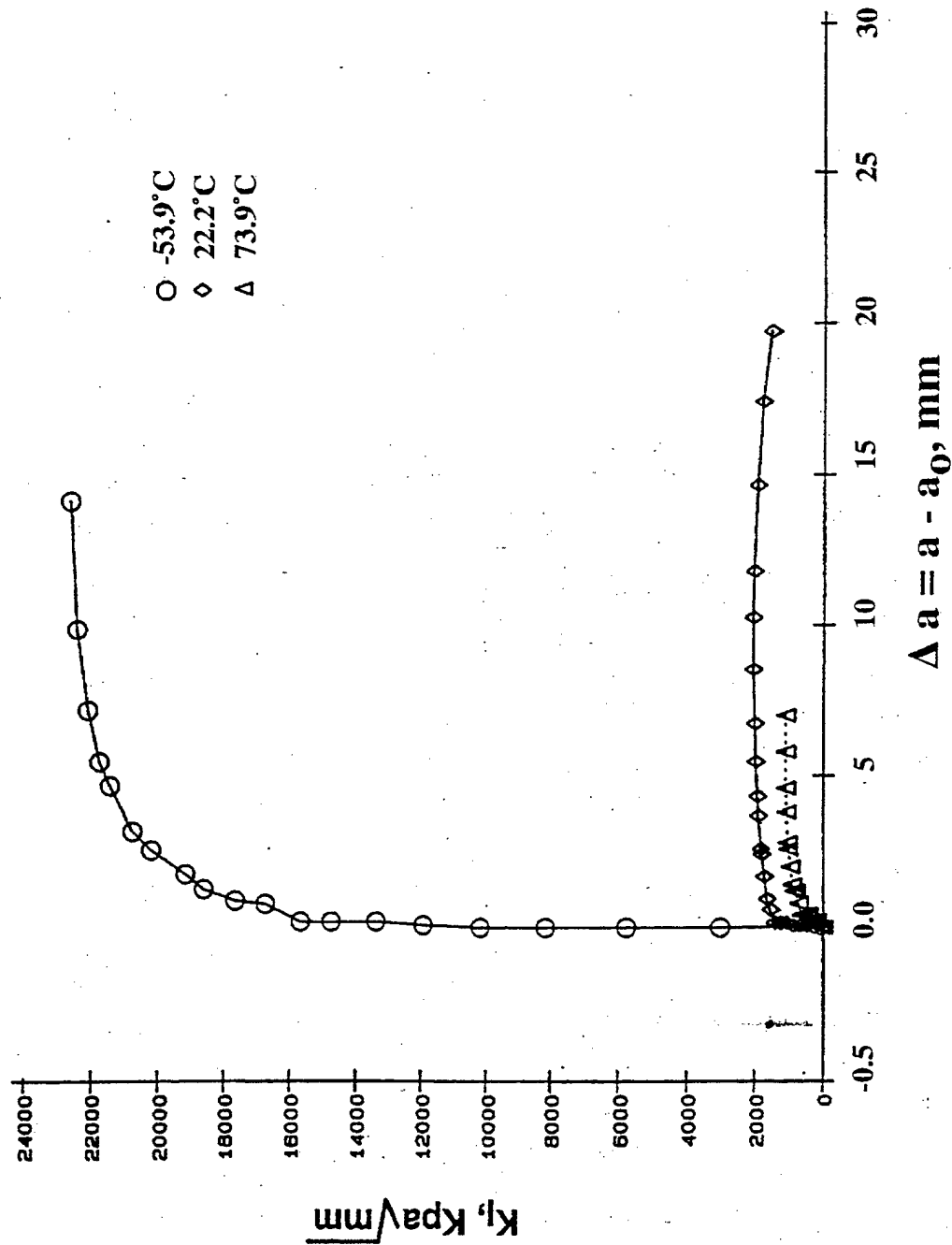


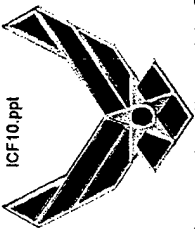
# Crack Growth Resistance Curves ( $t=2.54\text{mm}$ )



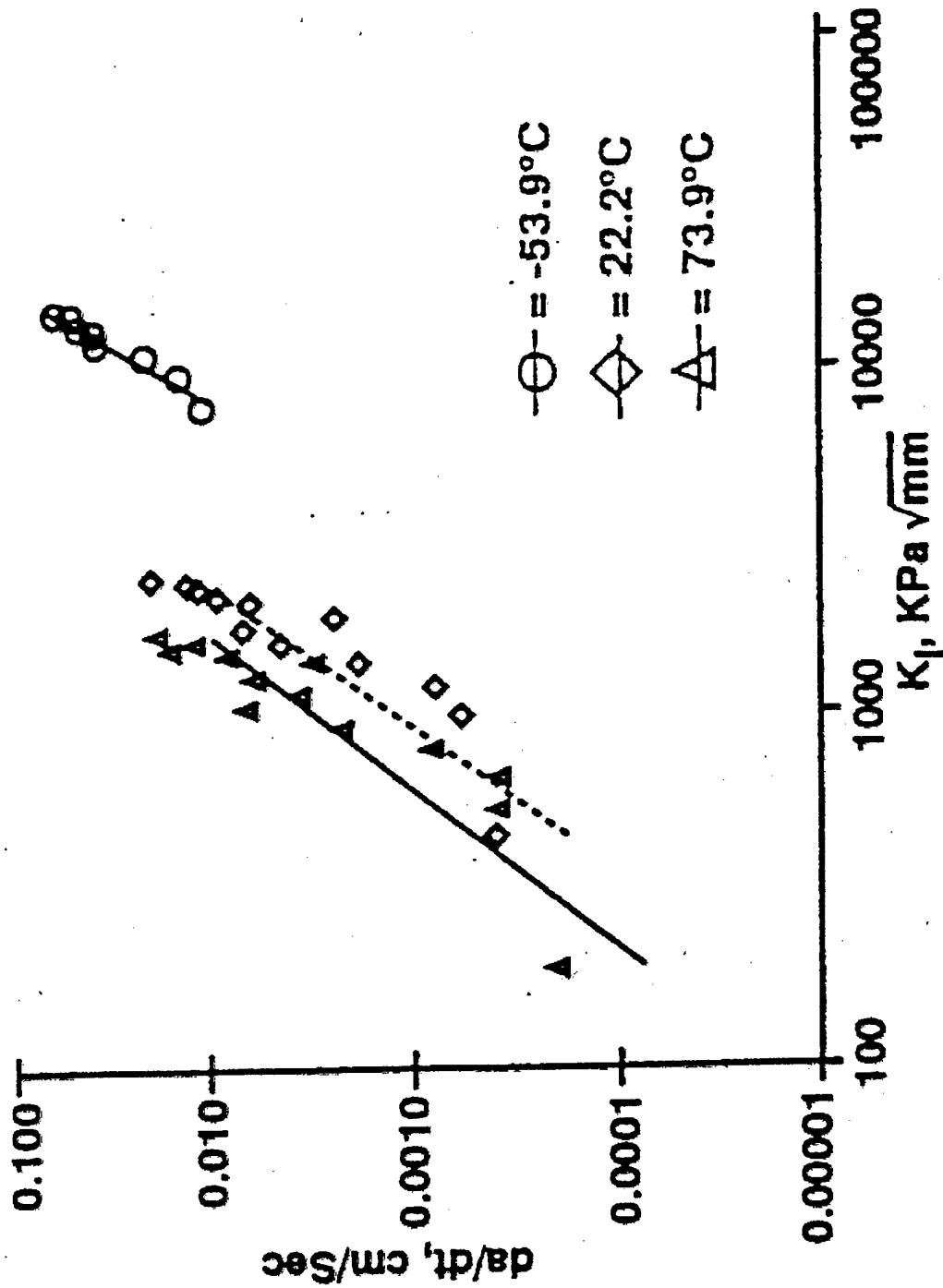


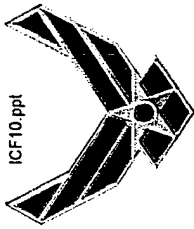
# Crack Growth Resistance Curves ( $t=12.7\text{mm}$ )



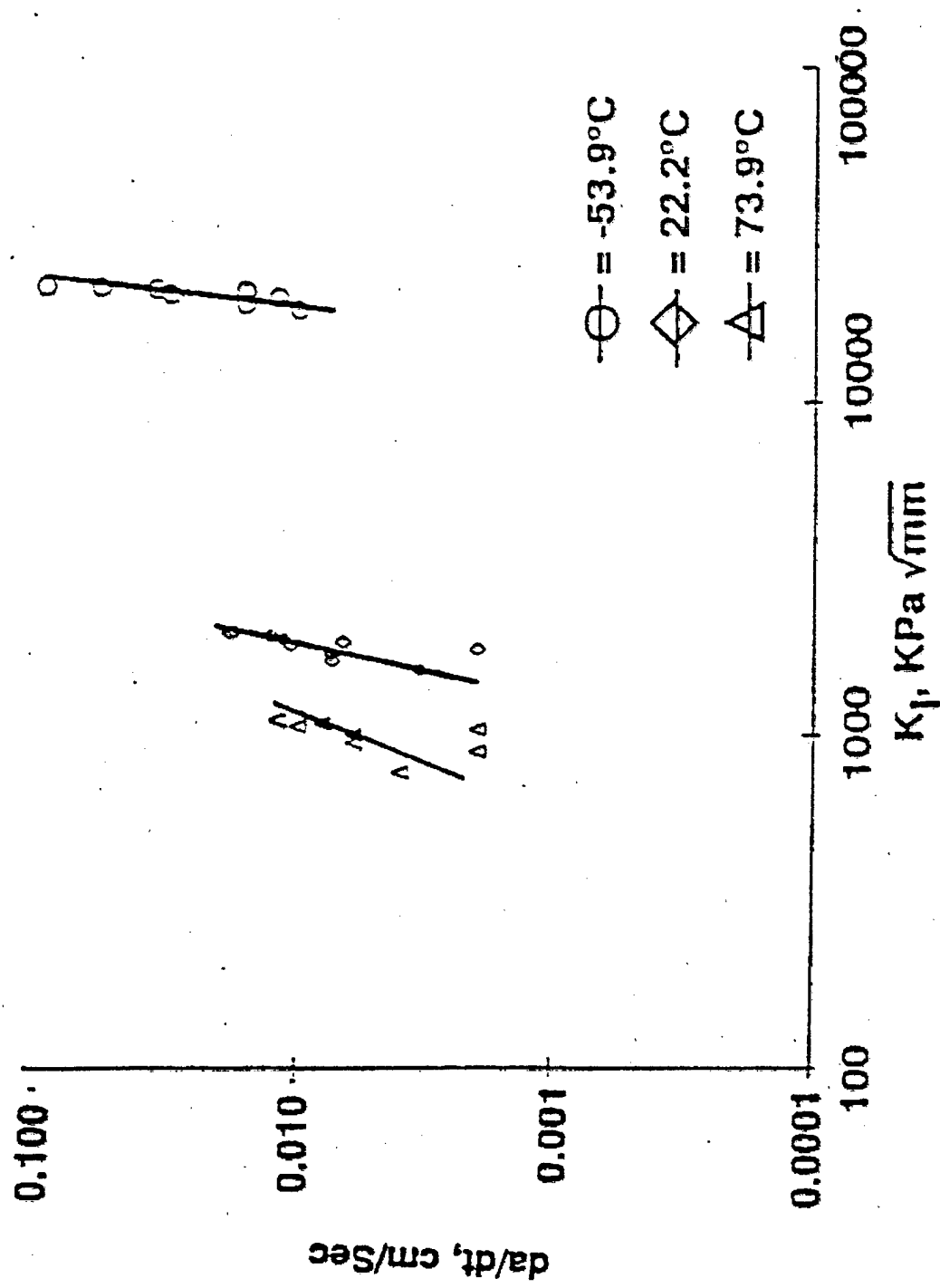
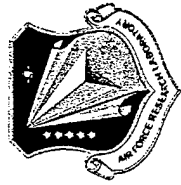


# Crack Growth Rate Versus Mode I Stress Intensity factor ( $t=2.54\text{mm}$ )

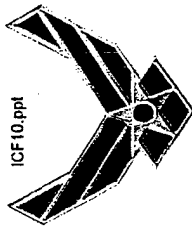




# Crack Growth Rate Versus Mode I Stress Intensity factor ( $t=12.7\text{mm}$ )







# Conclusions

*This is an "observation". Can you draw some conclusion from it?*

- The crack growth behavior at  $-53.9^{\circ}\text{C}$  is significantly different from that at  $22.2^{\circ}\text{C}$  and  $73.9^{\circ}\text{C}$ .
- The increase in specimen thickness alters the local strain fields but the iso-strain contours are of the same general form.
- A power law relationship exists between the Mode I stress intensity factor and the crack growth rate.